

THE BEAN BAG

Current Research on Legumes



R.S. Cowan, Editor

Department of Botany

Smithsonian Institution

Washington, D.C. 20560

X Charles R. Gunn, Associate Editor

Plant Taxonomy Laboratory

BARC-WEST, USDA

Beltsville, Maryland 20705

Number SIX

November 1977

FROM THE EDITORS: The International Legume Conference at Kew 24 July to 4 August, 1978 continues to promise large dividends for the time and effort being invested by participants. In June a Working Party on the Systematics of the Genisteae met at Southampton in preparation for the Conference [F. A. Bisby report]. The two-day meeting was attended by about 20 European taxonomists, chemists and cytologists with interests in the Genisteae. On the first day surveys were presented of serological, protein electrophoresis, flavonoid, free amino-acid, alkaloid, pollen and cytological data, some of which showed interesting disagreement with the various morphological classifications. The second day involved much debate. Amongst the taxonomists there was a surprising level of agreement on how the chemical data could resolve ambiguities which have bedevilled classification based on morphology. Indeed a system was agreed by most participants and is now being circulated for further comment.

The Conference organizers have now mailed a provisional programme and they have informed us that only a few invitations remain of those to be issued for the taxonomy sessions. Invitations for the agronomic sessions in the second week have all been distributed.

And, if the program needs another idea, Jim Lackey writes, "After reading Steve Darwin's paper in TAXON concerning the subfamilial, tribal, and subtribal nomenclature of Rubiaceae, it occurred to me that Fabulogists are probably using many incorrect names at these levels in the Leguminosae. Two examples which immediately come to mind are the Papilionoideae as a substitute name for the Faboideae, and the use of Viciae instead of Fabeae (see Article 19). Someone with an inclination towards nomenclature might like to study the situation before the Legume Conference."

The Bean Bag now goes to about 250 individuals and libraries around the world. The editors plan for the May 1978 issue to be a directory of BB readers--our special contribution to the Legume Conference. We ask for your cooperation by returning the red sheet which is a part of this issue. TO APPEAR IN THIS FIRST WHO'S-WHO IN THE WORLD OF LEGUMES, YOU MUST RETURN THE FORM WITH QUESTIONS 1-6 ANSWERED, NOT LATER THAN 1 APRIL.

* * * * *

CHANGE OF ADDRESSES AND CORRECTIONS - You may wish to record these changes in earlier issues.

CLARK, E. A., Bean Program, CIAT, Apartado Aéreo 67-13, Cali, Columbia. (BB5, page 2).

FILGUEIRAS, T. de S., Cx. Postal 973, Goiânia, Goiás 74000, Brazil. (BB-1, page 6).

GREAR, J. W., 146 Stanyan Street, San Francisco, California 94118, USA (BB-1, page 6).

LACKEY, J. A., Botany Department, NHB 166, Smithsonian Institution, Washington, D.C. 20560, USA. (BB-2, page 3).

LEE, D. W., Institut Botanique, 5, Rue Auguste Broussonet, Montpellier, France. (BB-1, page 7).

STAINIER had his name incorrectly spelled (Stainer) in the Additions to Bean Bag Readership column of BB-5, page 3 [Apologies!].

* * * * *

ADDITIONS TO BEAN BAG READERSHIP. (Please save this list as well as those in BB-1-5 for your future use. The May 1978 issue of the Bean Bag will contain a single alphabetical list of all BB readers along with their titles, addresses, and specialties.)

BARKOUDAH, Y., Department of Botany, Faculty of Sciences, University of Damascus, Damascus, Syria. (Biology and autecology of Acacia raddiana.)

CHANDEL, K. P. S., National Bureau of Plant Genetic Resources, Campus, New Delhi 11012, India.

CUBERO, J. I., Escuela Técnica Superior de Ingenieros Agrónomos, Departamento de Genética, Apartado 246, Córdoba, Spain.

DEBOUCK, D. G., Centro Internacional de Agricultura Tropical, Apartado Aéreo 67-13, Cali, Colombia. (Phaseolus, other than P. vulgaris L.).

DIAS DOS REIS, W., Rua 5 No. 11, Agua Branca, Goiânia, Goiás 74000, Brazil. (Wood anatomy of legumes.)

FORDE, M. B., Grasslands Division, DSIR, Private Bag, Palmerston North, New Zealand. (Plant Introduction Officer)

GORENFLOT, R., Laboratoire de Biologie Végétale C, Université de Paris XI, Batiment 362, 91405 Orsay - Cedex, France.

GUEVARA, L. G., de, Facultad de Agronomía, Universidad Central Venezuelana, Maracay, Venezuela. (Mimosoideae of Venezuela.)

LALA, R., Services de Botanique, EES Sciences, Université de Madagascar, B. P. 906 Tananarive, Malagasy Republic.

LIBRARY, Chemical Abstracts Service, Ohio State Univ., P.O. Box 3012, Columbus, Ohio 43210 USA.

MAHESHWARI, J. K., National Botanic Gardens, Lucknow, India.

NARAYANAN, A., College of Agriculture, Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad - 500030, Andhra Pradesh, India. (Crop physiology).

NAYAR, N. M., Central Plantation Crops Research Institute, Regional Station, Vittal, 574243, Karnataka, India.

PERAZZO Barbosa, V., Centro de Ciecias e Tecnologia do U. F. Pb., Campus II, Areia 58397, Paraiba, Brazil.

RAMAMONJIARISOA, B., Department of Biology, University of Massachusetts, Amherst, Massachusetts 01003, USA. (Dalbergia spp. of East Africa and Madagascar.)

SCHULTZE-KRAFT, R., Centro Internacional de Agricultura Tropical, Apartado Aéreo 67-13, Cali, Colombia. (Tropical acid soil legumes.)

SONG, L., Centro Internacional de Agricultura Tropical, Apartado Aéreo 67-13, Cali, Colombia. (Phaseolus)

UNIVERSITY of NEBRASKA LIBRARIES, Lincoln, Nebraska 68588, USA.

WHITE, J. W., Centro Internacional de Agricultura Tropical, Apartado Aéreo 67-13, Cali, Colombia.

* * * * *

IDENTIFICATIONS. Following are names of specialists who have expressed willingness to identify legumes and the groups they will accept. Arrangements should be made directly with them, in advance of shipment, using addresses in BB-1-6.

FILGUEIRAS: Dipteryx.

HAQ: Arachis and Phaseolus.

HUL THOL: Peltophorum.

SMARTT: Arachis and Phaseolus.

* * * * *

GLEANINGS FROM DATA COLLECTING SHEETS. For addresses see readers lists in BB-1-6.

ARROYO writes that she has found a probable case of introgressive hybridization between two species of Copaifera in Central savannahs of Venezuela; just completed detailed study of pollinators of Copaifera pubiflora; has documented flowering periodicity for a period of four years in C. pubiflora with evidence for mast years. Populations present 3-4 flowering periods, each of 2-5 days length, separated by rest periods of up to two weeks. Also discovered details on the biology and rate of emergence (or infection) of three, apparently specific, seed predators. Needs information on breeding systems (presence of self-incompatibility; andromonecy, etc.) in legumes. Also observations on pollinators and their behavior - all for preparation of my talk at the Legume Conference. Information to Apartado 1969, Caracas, Venezuela.

BISBY, BELL, and J. H. Harris are investigating the free amino acids in seeds of the Cytisus/Genista complex. BISBY and M. T. Barac are experimenting with providing taxonomic services and retrieval of chemical information for tribe Viciaeae. BISBY and Harris have completed a survey of diverse taxonomic data for about 50 species of the Cytisus/Genista complex to study the problem of incongruence. Vegetative, pollen and floral morphology; seed proteins; free amino acids; seed alkaloids; floral

scent and UV reflectance were studied on cultivated plants of carefully documented, often wild, origin. Will exchange seeds of Genisteae as well as cuttings, fragments, flowers and pollen from collection of over 60 cultivated Genisteae species. Needs seeds of Viciae.

CHANDEL, a plant explorer in India, has been evaluating Alysicarpus, Atylosia, Clitoria, Crotalaria, Indigofera, Phaseolus, Rhynchosia, Teramnus, and Vigna. Works with Pisum, Psophocarpus, and Vigna and offers to exchange seeds of Alysicarpus, Atylosia, Pisum, and Vigna radiata, V. umbellata, and Psophocarpus tetragonolobus. Suggests a biosystematic study of Atylosia and its role in the evolution of Cajanus for a graduate student.

CORBY is searching for records of nitrogen content of seeds of Caesalpinioideae and Mimosoideae.

DEBOUCK would like to exchange seeds of Phaseolus s.s.; especially interested in wild species like P. formosus, P. pedicellatus, P. polystachyus, P. ritensis, et al.; also Neotropical Vigna and Macroptilium.

GIBBS sends this report. The Department of Botany of the State University of Campinas is collaborating with the Institute of Zootecnia Nova Odessa in a collection and study of the forage potential of native Brazilian legume species (Projeto Coleta e Introdução de Leguminosas Forrageiras, supported by the National Development Bank, BNDE, Funtec 280). The area of the collection extends between parallels 15-25°. Seed and nodule collections are accompanied by voucher herbarium specimens which are deposited at Campinas and Nova Odessa with further duplicates destined for Curitiba, Kew, New York, etc. Some 800 seed collections have been made so far, many of which are currently undergoing field trials. Future collecting trips are planned for southern Mato Grosso, west Paraná and Espírito Santo. Further information from Dr. Peter E. Gibbs or Dr. Hermógenes de Freitas Leitão Filho, Departamento de Botânica, UNICAMP, CxP. 1170, Campinas 13100, São Paulo, Brazil.

HAQ has started a cytogenetic investigation of Psophocarpus tetragonolobus and wants P. tetragonolobus from Malaysia, Indonesia, and Thailand as well as wild Arachis and Phaseolus spp.

HUL THOL has completed a palynological study of Saraca and with M. Hideaux has a paper in press on gross morphology and palynological characters of Pterolobium. Has started three projects: her dissertation on variation, speciation and evolution in the Caesalpinieae; revision of Peltophorum; and study of infrageneric parameters within Caesalpinia. Needs viable seeds of Acrocarpus, Caesalpinia, (including Mezoneuron), Delonix, Gleditsia, Gymnocladus, Parkinsonia, Peltophorum, Pterolobium, and Wagatea. See also VIDAL.

KRUKOFF needs seeds of these Indian genera: Aganope, Derris, Dunbaria, Eleiotis, Indopiptadenia, Leptodesmia, Nogra (Grona), Ougeinia, Oxyrhynchus, Rothia. Also needed are large seed samples and one kilo of dried roots of Derris as well as seeds of Lonchocarpus for amino acid, alkaloid, and flavonoid studies.

LACKEY was selected as a postdoctoral fellow by the Smithsonian Institution for one year beginning 1 June 1977. During this time the collections of American Phaseolinae will be studied to develop a generic revision of the group along the lines of Roger Polhill's recent revision of Genisteae. In October, he will visit the laboratory of Nels Lersten to prepare for publication a section of his dissertation on anatomy of Phaseoleae leaves.

LANGENHEIM see SILVA

SCHULTZE-KRAFT writes that CIAT is currently emphasizing acid-soil legumes (Aeschynomene, Centrosema, Desmodium, Galactia, Macroptilium, Stylosanthes, and Zornia) in their beef production program. Collection trips are made to the savanna regions of Brazil, Colombia, and Venezuela. About 3,000 legume accessions have been evaluated by the program. He would like to exchange tropical legume herbarium specimens and germplasm.

SILVA has started to monograph Dimorphandra Schott and to collect data for a monograph of Copaifera with LANGENHEIM. Would like photographs of species of the two genera as well as bibliographic data and type photographs.

SLINKARD needs seeds of Lens spp. other than L. culinaris (L. esculenta).

SMARTIT is studying the cytogenetics of Psophocarpus tetragonolobus and needs seeds from Indonesia, Malaysia, and Thailand. Also needs seeds of wild species of Arachis and Phaseolus.

SONG maintains, evaluates and distributes some 12,000 accessions of Phaseolus vulgaris and is interested in developing some form of numerical taxonomy for identifying duplicate samples as well as for future sampling requirements.

VIDAL and HUL THOL have named a new species of Saraca and completed a palynological study of the genus. Plan to revise genus Peltophorum. See also HUL THOL.

* * * * *

RECENT (POST 1975) LEGUME LITERATURE. When preparing a citation of your published legume paper or legume papers of general interest, please follow the form used in this BB. Use additional key words when needed to supplement the title. Major publications may have brief reviews. For additional information or reprints write to the author or authors whose names are fully capitalized. Their addresses may be found in BB-1-6. Only papers with complete citations will be accepted; citations of papers in press should not be submitted.

AGERER-KIRCHHOFF, C. 1976. Revision von Astragalus L. section Astragalus. Boissiera 25: 1-197. [New taxa, maps.]

Annotated bibliography on Fenugreek (Trigonella foenum-graecum) 1969-1975. 1975. Comm. Bur. Hort. Plantation Crops. 4 pages.

Akovlev, G. P. [the author's name may be spelled incorrectly]. 1976. Review of genus Luetzelburgia Harms. Biol. Nauki 9: 74-77.

Aplin, T. E. H. 1976? Poison plants of western Australia: Gastrolobium and Oxylobium. Bull. Western Aust. Dept. Agr. No. 3772, 66 pp.

Areekul, S., P. Kirdudom, and K. Chaovanapricka. 1976. Studies on djenkol bean poisoning (djenkolism) in experimental animals (Pithecellobium jiringa and P. lobatum). Southeast Asian J. Trop. Med. Public Health 7: 551-558.

BARBOSA-FEVEIREIRO. 1977. Centrosema (A.DC.) Bentham do Brasil. Rodriguesia 29(42): 159-220. [26 spp., keys, descriptions, phytogeography etc.].

Basak, M. K. and S. K. Goyal. 1975. Studies on tree legumes. Part 1. Nodulation pattern and characterization of the symbiont. Ann. Arid Zone 14: 367-370.

- BAUDET and MARECHAL. 1976. Taxonomic significance of the presence of hooked hairs in certain genera of Phaseoleae and Hedysareae. *Bull. Jard. Bot. Natl. Belg.* 46: 419-426.
- Bochaniseva, V. V. 1976. Chromosome numbers of two shrubs from family Leguminosae. *Bot. Zh. (Leningrad)* 61: 1441.
- Brunsberg, K. 1977. Biosystematics of Lathyrus pratensis complex. *Opera Bot.* 42: 1-78.
- BURKART and CARTER. 1976. Notas en el Genero Cercidium (Caesalpinoideae) en Sud America. *Darwinion* 20: 305-311. [Please note this correction: p. 308, line 15: por México y California lee el No de México. And this distribution is shown on Karte no. 25, not K. 26. The latter refers to South America, Central America and SW Mexico.]
- Carr, J. D. 1976. South African acacias. Conservation Press, Johannesburg. 323 pages, illustrated.
- Chekalin, N. M. 1975. Nature of the manifestation of selective fertilization in inbred lines and hybrids of Lathyrus sativus. *Selektsiya i Semenovodstvo Resp. Mezhd. Temat. Nauch. SB.: Referativnyi Zhurnal* (1975) 12: 55-271.
- COWAN. 1977. Studies of tropical American Leguminosae-VIII. *Proc. Biol. Soc. Wash.* 90(2): 237-242. [New spp. Dicymbe and Macrolobium, first description of fruit of Candolleodendron.]
- CRISTOFOLINI. 1976. Italian species of Cytisus section Tubocytisus. *Webbia* 30: 257-284.
- CRISTOFOLINI. 1977. Serological systematics of tribe Genisteae. *Taxon* 26: 43-56.
- Cruden, R. W. 1976. Fecundity as a function of nectar production and pollen-ovule ratios, pp. 171-178. In J. Burley and B. T. Styles, *Tropical trees: variation, breeding and conservation*. Academic Press. [Caesalpinia pulcherrima and Calliandra spp.]
- Cruden, R. W. and V. M. Toledo. 1977. Oriole pollination of Erythrina brevipflora: Evidence for a polytypic view of ornithophily. *Plant Syst. Evol.* 126: 393-403.
- Dominguez, E. 1976. Revision of annual species of genus Hippocrepis. *Lagascalia* 5: 225-261.
- Elmes, R. P. T. 1976. Cross-inoculation relationships of Psophocarpus tetragonolobus and its rhizobium with other legumes and rhizobia. *Papua New Guinea Agr. J.* 27(3): 53-57.
- Evans, C. S., Qureshi, M. Y. and BELL. 1977. Free amino acids in the seeds of Acacia species. *Phytochemistry* 16(5): 565-570.
- FILGUEIRAS and E. Silva. 1975. Estudo preliminar do Baru. *Brasil Florestal* 6(22): 33-39.
- Fouzdar, A. and S. L. Tandon. 1976. Cytogenetical evolution in the genus Pisum. *Cytologia* 41: 91-104. [P. abyssinicum Braun, P. arvense L., P. elatius Stev., P. jomardii Schrank, P. sativum L.]
- Garcia, M. U. 1975. Floral biology of Amherstia. *Pterocarpus* 1: 26-35.

- GESINK. 1976. A provisional key to the genera and some species of the S. E. Asiatic Leguminosae-Faboideae. Flora Malesiana Miscellaneous Records IV. Rijksherbarium, Leiden.
- GUINET and R. Lugardon. 1976. Diversity of exine structures in genus Acacia: Pollen and Spores 18: 483-511.
- Hamant, C., N. Lescanne and VASSAL. 1976. Some chromosome numbers in genus Acacia. Taxon 24: 667-670. [51 species.]
- HUL THOL. 1975. Types polliniques de quelques Caesalpiniaceae asiatiques. Structure et terminologie de la sporo-pollinique. Document Assoc. Palyno. Lang. France (CEGET-CNRS, Paris) 20: 23-25.
- Ibrahim, A. M. 1974. Interspecific hybridization between Phaseolus vulgaris L. and P. coccineus Lam. Dissertation Abstracts International 34.5.1995B.
- IRWIN and R. C. Barneby. 1976. Two new species of Cassia subgenus Senna. Brittonia 28: 430-434.
- IRWIN and R. C. Barneby. 1976. Nomenclature notes on Cassia. Brittonia 28: 435-442.
- JANZEN. 1977. Variation in seed size within a crop of a Costa Rican Mucuna andreana. Am. J. Bot. 64: 347-349.
- KUPICHA. 1977. Delimitation of the tribe Viciae (Leguminosae) and the relationship of Cicer L. Bot. J. Linn. Soc. 74: 131-162. [Cicereae evaluated.]
- LACKEY. 1977. A revised classification of the tribe Phaseoleae (Leguminosae, Papilionoideae), and its relation to canavanine distribution. Bot. J. Linn. Soc. 74(2): 163-178.
- LACKEY. 1977. Neonotonia, A new generic name to include Glycine wightii (Arnott) Verdcourt. Phytologia 37: 209-212.
- LACKEY. 1977. A synopsis of Phaseoleae (Leguminosae, Papilionoideae). Ph.D. dissertation. Iowa State University, Ames. [A revised classification of the tribe Phaseoleae is proposed which recognizes seven subtribes: Cajaninae, Diocleinae, Kennediinae, Phaseolinae, Glycininae, Ophrestiinae, and Erythrinae. It is based on herbarium studies (illustrated with 128 sketches of floral dissections) supplemented with data from chromosome numbers, leaflet anatomy, electrophoresis of seed proteins, and literature findings. Copies have been sent to ISC, K, MO, NY, and US.]
- LESINS, Sadasivaiah, R. S. and S. M. Singh. 1976. Relationship of taxa in Medicago as revealed by hybridization. VIII. Section Rotatae. Canadian J. Genetics and Cytology 18: 345-355.
- MACNOCHIE. 1977. New combination in Flemingia. Muelleria 3: 198.
- t'MANNETJE. 1977. Revision of varieties of Stylosanthes guianensis. Australian Journal Botany 25: 347-362.
- MASLIN. 1977. Studies in the genus Acacia (Mimosaceae): 6. Miscellany. Nuytsia 2(3): 145-161.

- Meeson, B. W. 1977. Pollen morphology of Dalea section Cylipogon. Sida Contrib. Bot. 7: 13-21.
- Mitchell, R. 1977. Bruchid beetles and seed packaging by palo-verde. Ecology 58: 644-651.
- Nguyen, Van Thuan. 1977. Phaseolées asiatiques nouvelles. Adansonia (Paris) 16(4): 509-514.
- NOZZOLILLO. 1977. Identification of Vicia seedlings. Canadian Journal Botany 55: 2439-2462. [Seedling photographs.]
- OHASHI. 1977. Nomenclatural changes in several Himalayan Leguminosae. J. Jap. Bot. 50(10): 305-309. [New combinations.]
- Podlech, D. 1976. Taxonomic position of Astragalus acaulis. Mitt. Bot. Staatssaml. Muench 12: 341-350.
- REMBERT. 1976. Ovularian pollen chamber in Trifolium repens. Phytomorphology 26:
- REMBERT. 1977. Ovule ontogeny, megasporogenesis, and early gametogenesis in Trifolium repens (Papilionaceae). Amer. J. Bot. 64: 483-488.
- RUDD. 1976. Mimosa: Notes and novelties from Colombia. Phytologia 33: 233-237.
- SALEH and M. S. Ishak. 1976. Anthocyanins of some Leguminosae flowers and their effect on colour variation. Phytochem. 15: 835-836.
- Santamour, F. J., Jr. 1977. Flavonoid distribution in Gleditsia chemotaxonomy. J. Arboric. 3(1): 14-18.
- Sareen, T. S. 1975. Chromosome numbers in some species of Cassia L. Indian Forester 2: 142-144.
- SILVA. 1976. Revisão taxonomica do genero Peltogyne Vog. Acta Amazonica 6(1). Suplemento. 61 p.
- Spellenberg, R. 1976. Chromosome number as an indication of relationships of Astragalus section Strigulosi (Leguminosae) with descriptive notes on A. altus. Southwestern Naturalist 4: 393-396.
- STAINIER. 1976. Note sur le pollen de quelques especes sud-Americaines du complexe Phaseolus-vigna. Pollen and Spores 18: 523-531.
- Stebbins, G. L. 1976. Seed and seedling ecology in annual legumes. 1. Comparison of seed size and seedling development in some annual species. Oecologia Plantarum 11: 321-331. [In 6 annual Medicago spp., 5 annual Vicia spp., 2 Trifolium spp. and 1 each of Scorpiurus and Coronilla. Seed size and seedling vigor were positively correlated. But growth relative to seed size was greater in species with small seed than in those with large seed due to transfer from the cotyledons to other parts of the seedling in the latter. In species with small seed, photosynthesis contributed to growth earlier than in species with large seed. There was no correlation between seed weight and seedling growth rate at 10-42 days after sowing. The advantages of greater adaptive ability and competitiveness in species with large seed was outweighed by the disadvantage of the smaller number of seeds produced and the less-efficient seed dispersal.]

- Stebbins, G. L. 1976. Seed and seedling ecology in annual legumes. 2. Stem growth. Seed production and mechanisms for transport. *Oecologia Plantarum* 11: 333-344. [Observations of 6 annual *Medicago* spp. and species of *Medicago*, *Melilotus* and *Trifolium* growing wild near Montpellier, France showed that length of time from anthesis to seed maturity was positively correlated with seed size, but differences in the former were less than those in the latter. There was little difference among species in the amount of stem material produced/gram of seed. With species with small seed producing more seeds/unit stem than species with large seeds. The weight of accessory organs for seed dispersal was positively correlated with the degree of specialization for animal transport. Among the *Medicago* spp. those with small seeds have achieved greater evolutionary success than those with large seeds. The greater evolutionary success of *Trifolium* can be attributed, at least in part, to the evolution of a calyx which serves as an accessory organ in seed transport.]
- Steinegger, E. and S. Scheurer. 1976. Chemotaxonomische untersuchungen an *Genista hystrix* Lange. 21. Mitteilung über leguminosen-alkaloide. *Pharm. Acta Helv.* 51: 203-204.
- TINDALE. 1975. Notes on Australian taxa of *Acacia*, No. 4. *Telopea* 1: 68-83.
- VASSAL. 1975. Comparative histology of seed coat in several African *Acacia* spp. *Travaux Lab. Forestier Toulouse*. Tome 1. 9: art. 13.
- VIDAL and HUL THOL. 1976. Revision des caesalpinia asian. *Bull. Mus. Natl. Hist. Nat. Ser. 3*, 395 (Bot.27): 69-135. [English summary.]
- What is *Gleditsia officinalis* Hemsley? 1975. *Acta Phytotaxonom Sinica* 13: 47-50.
- WUNDERLIN. 1976. Enumeration and typification of genera in the tribe Cercideae (Leguminosae). *Rhodora* 78: 750-760.
- WUNDERLIN. 1976. The Panama species of *Bauhinia* (Leguminosae). *Ann. Mo. Bot. Gard.* 63: 346-354.
- YAKOVLEV. 1977. Review of the genus *Luetzelburgia*. *Biol. Nauki (Moscow)* 19: 74-77.



FIGURE 116.—*Pueraria lobata* (Willd.) Ohwi. Kudzu. A, Habit— $\times 0.5$; B, root— $\times 0.25$; C, flower— $\times 2$; D, legumes— $\times 0.5$; E, seeds— $\times 2.5$.

From U.S. Department of Agriculture,
 Agricultural Handbook Number 366, 1970.